QC/QA of LTPP Monitoring Data

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Purpose and Goals

- Highlights of an important part of the LTPP program
- Give some background and issues
- Understanding the steps taken to ensure quality data – used in M-E PDG development
- Identify practices applicable to “routine” data collection activities

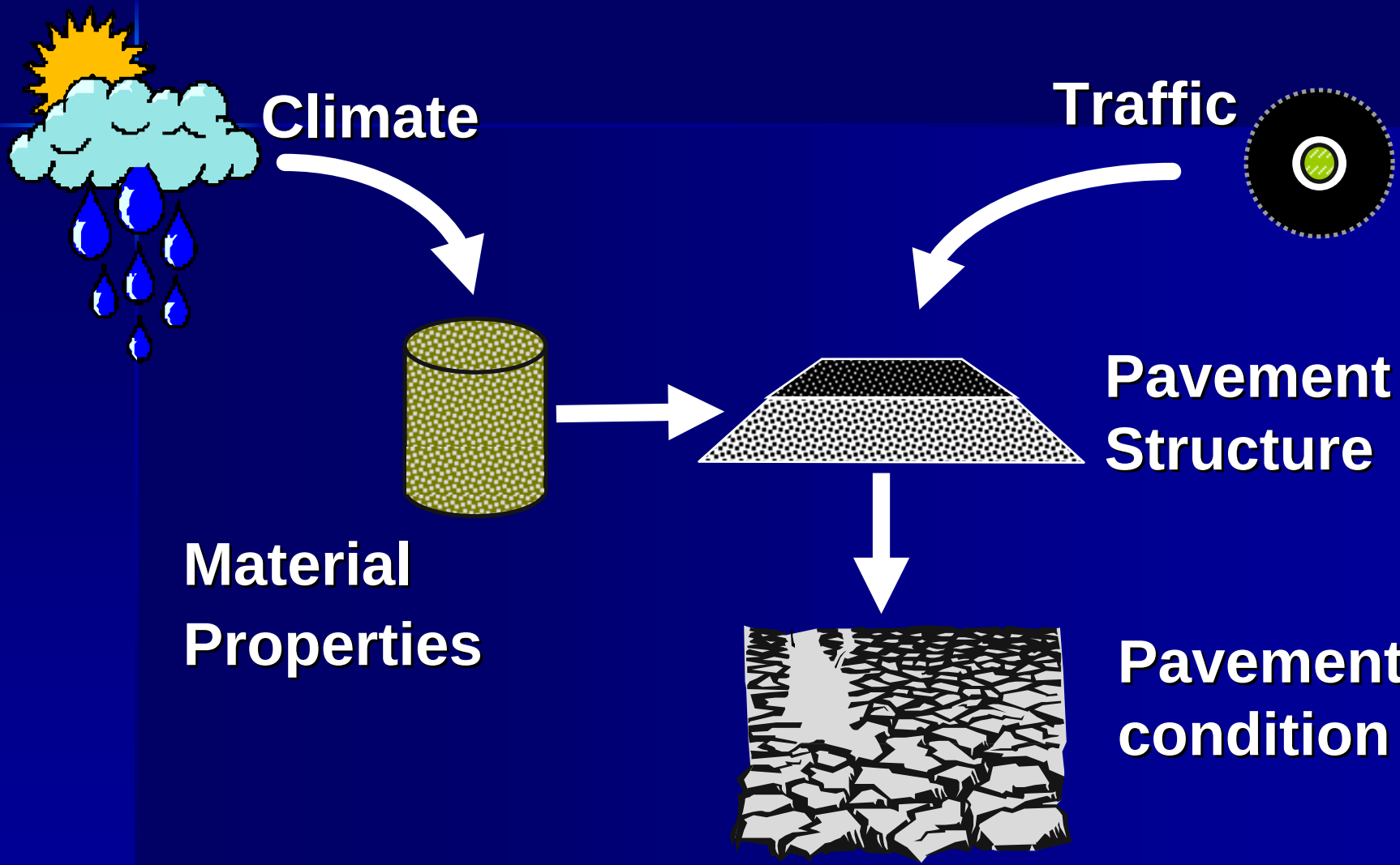
SHRP LTPP Objectives

- Evaluate existing design methods.
- Develop improved design methodologies and strategies for the rehabilitation of existing pavements.
- Develop improved design equations for new and reconstructed pavements.
- Determine the effects of loading, environment, material properties and variability, construction quality, and maintenance levels on pavement distress and performance.
- Determine the effects of specific design features on pavement performance.
- Establish a national long-term database to support SHRP's objectives and to meet the future needs of the highway industry.

LTPP Organization

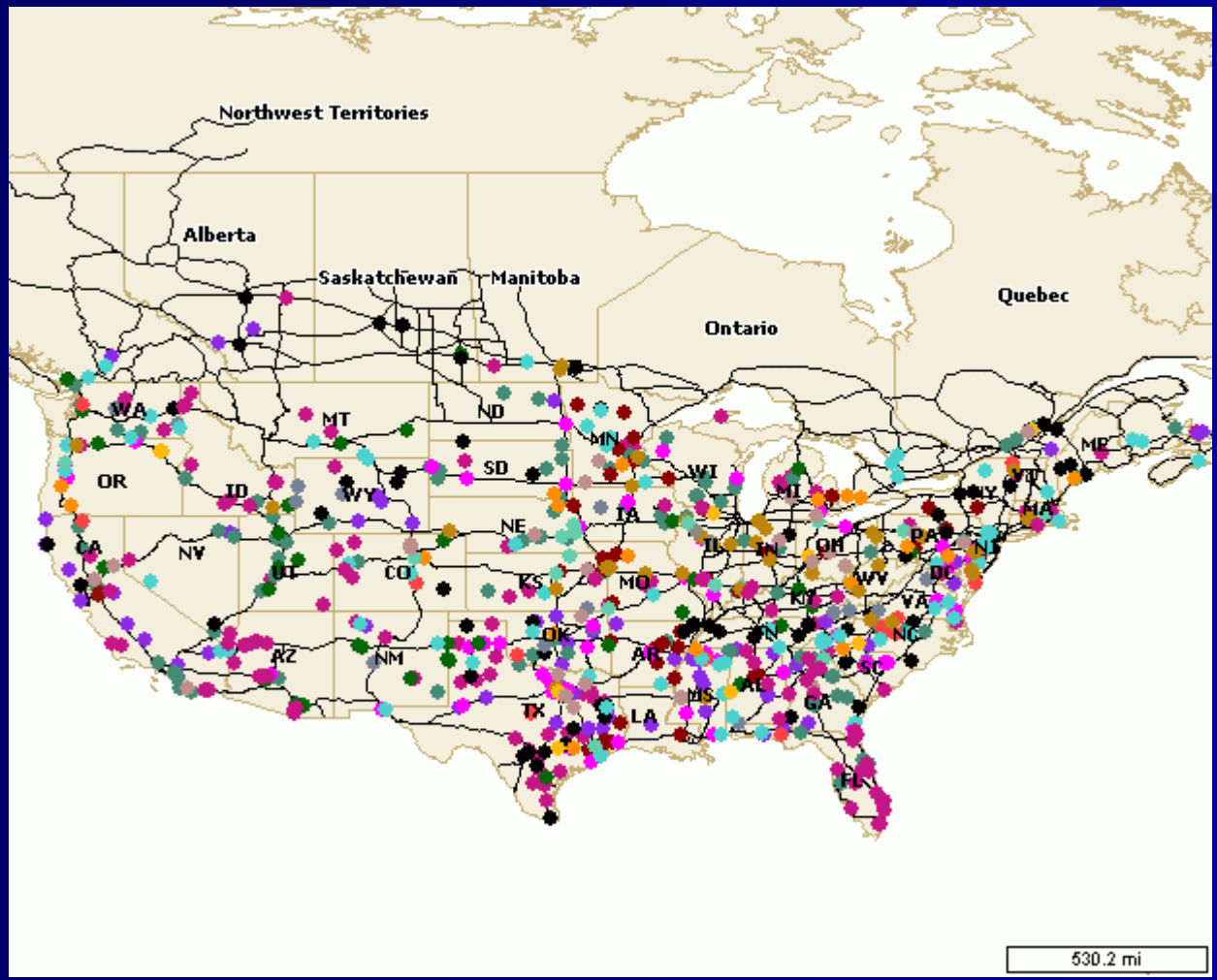
- SHRP – FHWA (PPD/LTPP Team)
  - Technical Services Support == Guidelines
    - MACTEC (aka PCS/Law), S&ME, SAIC
  - Regional Support Contractors == Data Collection/Handling/Upload for Profile, Manual Distress, FWD
    - Stantec – North Atlantic
    - Fugro-Bre - Southern
    - Nichols - Western
    - Braun, ERES, Stantec – North Central
  - Distress filming contractor == Program-wide distress data
    - PASCO USA/CGH/ERES – same folks since 1989

LTPP Data Collection



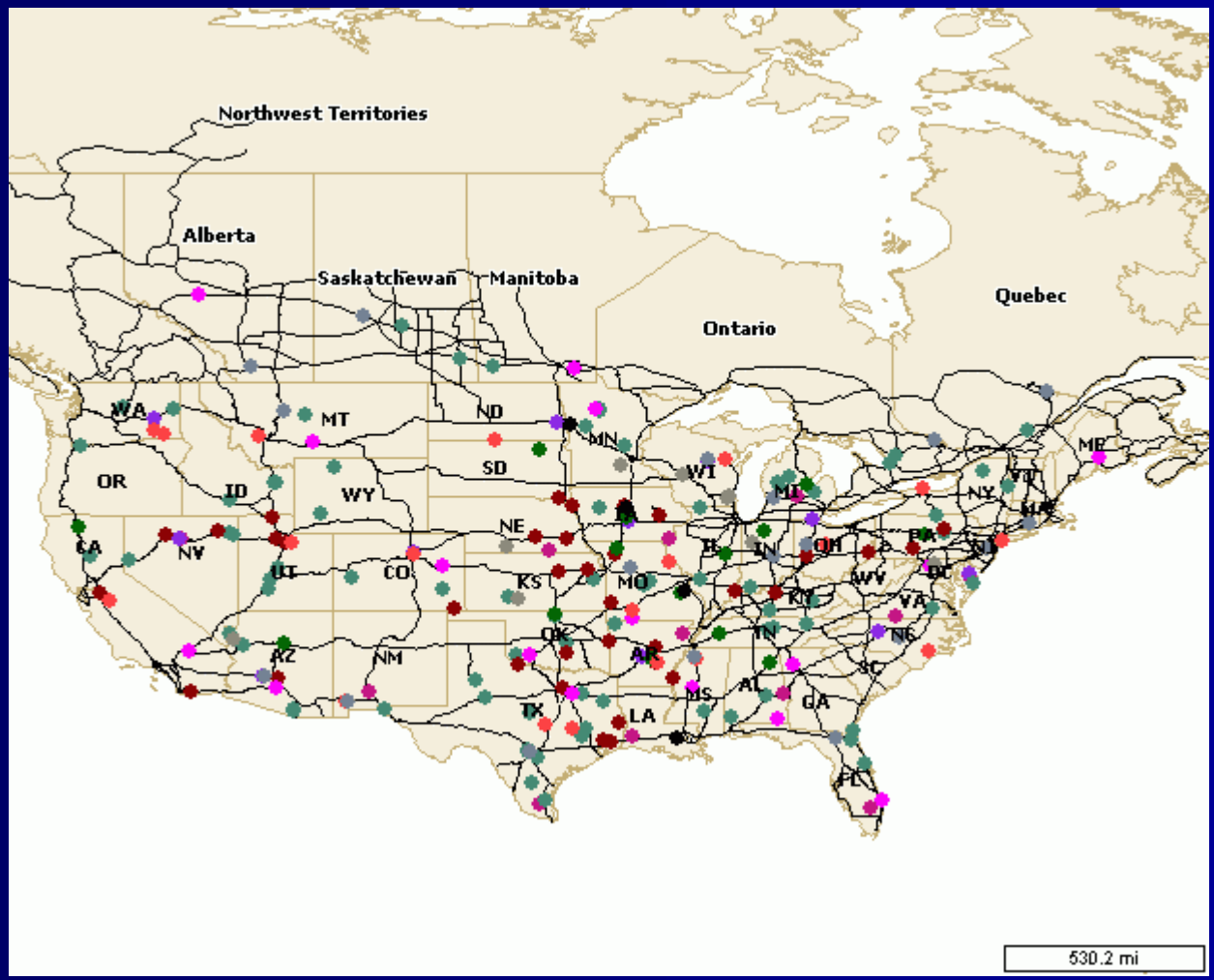
General Pavement Studies

Almost 800 test sections



Specific Pavement Studies

About 230 sites, over 1700 test sections



LTPP Monitoring Data Types
Used in M-E PDG

- Distress (manual and film)
  - AC
    - rutting, thermal cracking, fatigue cracking
  - PCC
    - faulting, slab cracking
- Profile (automated, manual)
  - Longitudinal => IRI
  - Transverse => rutting
- Deflection (FWD only)
  - Layer properties
  - Load transfer efficiency, void detection

Data Collection Frequency

- From ~1988 to present
  - 2500+ sections at 900+ locations
  - Visits timed by prioritization ($ vs. criticality)
  - Data Type – profile had most visits; FWD and distress needed traffic control
- Some few had only one set of each type

GB of data over thousands of visits

What is Good Data?

What do we need and how can we be sure it is good?

- Repeatable?
  - Within operator/device
  - Between operator/device
- Sources of variability are understood and measured
  - Equipment/method
  - Actual conditions
- Fits expectations? (what is truth?)

General Approach

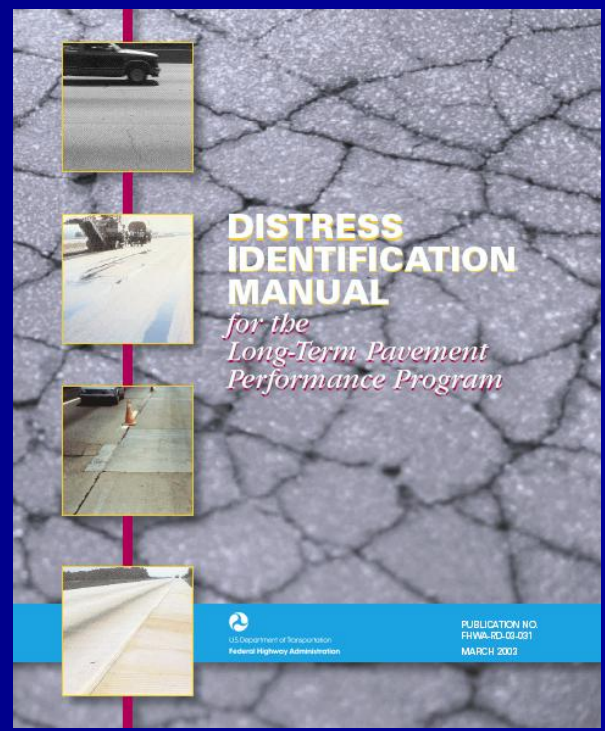
- Choose a method/standard
  - What are we measuring?
  - What additional data items affect results/use of data?
- QC
  - Calibrations
  - Detailed field procedures
  - Look at results
  - Data handling/security
- QA
  - Train the users
  - Procedures followed?
  - Side-by-side comparisons
  - Comparable results?

Distress

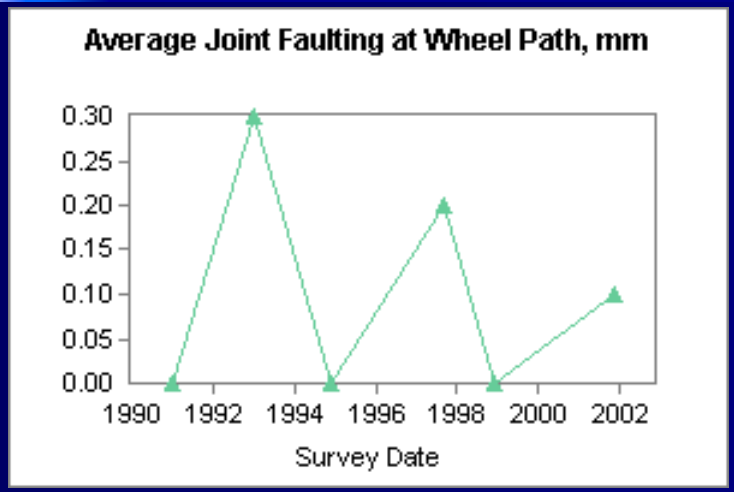
- Key data – distress specific performance models in M-E PDG
  - Cracking, rutting, faulting
- Subjective
- Can dozens of people arrive at the same answers?
  - Standards
  - Training
  - Review and feedback
- Is data from manual surveys the same as from film?

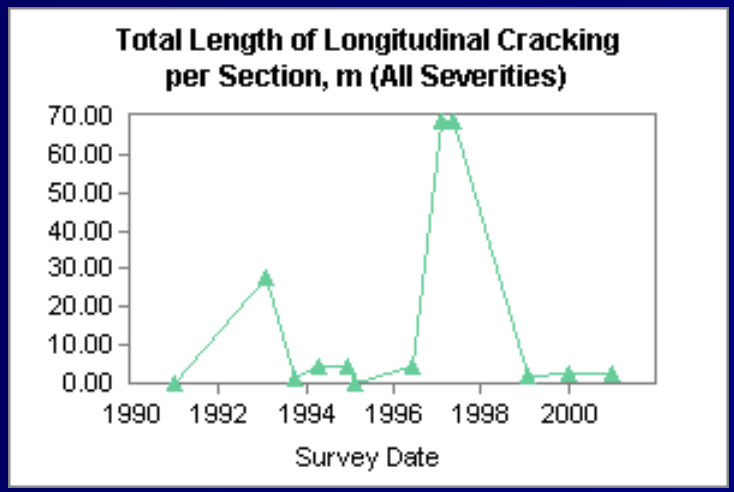
Distress Identification Manual

- ETG-vetted definitions
  - Concise
  - Specific – limit “discretionary” interpretation
- Evolving procedures
  - Eliminate a few distresses
  - Refine field procedures
  - Refine office review
- Basis for Workshops



Distress Issues





- Faulting: looks suspect – field procedures
- L-cracking: possible change in lateral limits - error

Adjustments - Distress

- Feedback from field – incorporated into procedures
- Office reviews – data viewing software
- Review of prior surveys as part of new survey
- Eliminating/redefining some distresses:
  - AC reflection cracking
  - WP Longitudinal worse than Low severity
  - PCC popouts
- Data studies
  - Fault measurement variability
  - Comparison between manual and film-derived distress
  - Variability studies

Deflection

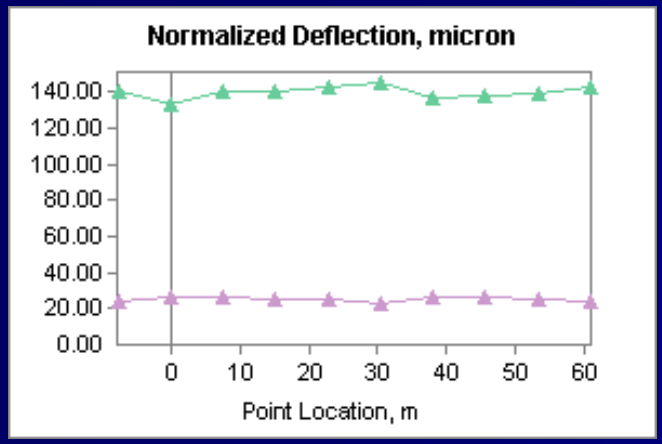
- Detailed procedures:

  "LTPP Manual for Falling Weight Deflectometer Measurements Operational Field Guidelines v3.1"
- Developed RefCal system
  - NIST traceable for components (temperatures, deflectors, load cell)
  - Narrow tolerances
- QC/QA software
  - FWDSCAN; FWDCHECK
  - SLIC
- Training

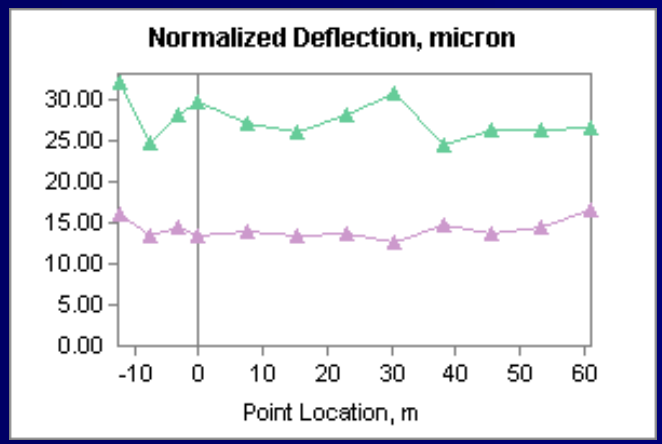
Deflection Issues

- Temperature measurement
  - Direct, IR
- Sensor spacing
  - When did No. 3 get moved?
- Buffer shape
  - Significant?
- Backcalculation….
  - Computed parameters in IMS PPD

Deflection – As Expected



- Unfrozen



- Frozen

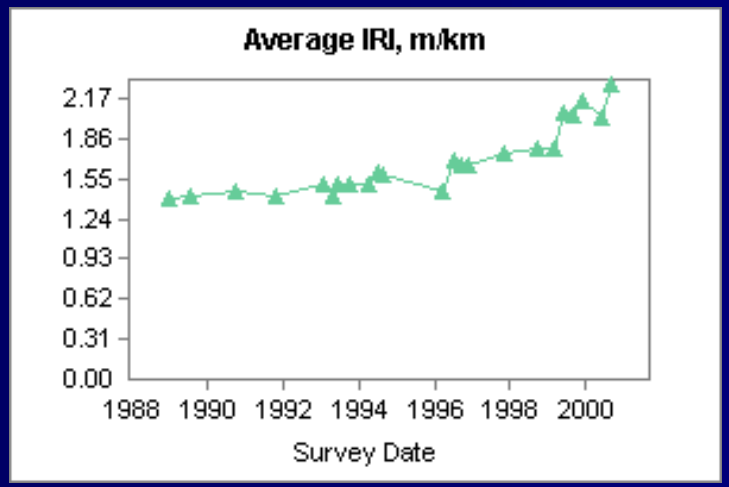
Profile

- Detailed procedures:
  - “LTPP Manual for Profile Measurements and Processing Version 4.1”
- Developed Procedures for multiple devices
  - KJ Law Profilometer
  - FACE Dipstick
  - ICC Profiler
- QC/QA software
  - ProQual – used in field and office
- Rodeo’s and operator training

Profile Issues

- Comparisons
  - Between “same” equipment
  - Between different devices
- Running the same path
- Starting at the same point

Profile – Expected Trend



- Most time-series data

Smoothness is basis for M-E PDG performance model

IRI = f(predicted distress)

Good Data Comes From

- Consistent procedures
- Trained personnel
- Calibrated, well maintained equipment

LTPP used QA audits for Distress, Deflection, Profile and office procedures

LTPP Data and M-E PDG

- Validation and Calibration
- Material Characterization
  - LTPP soil Mr test procedure
  - Source of typical values
- Environmental Effects
  - Source of climatic data
- Evaluation of Existing Pavements
  - LTPP's backcalculation procedure
  - FWD calibration procedures

Variability

- Every element of the pavement “problem”
  - Traffic
  - Climate
  - Material Properties
  - Response (distress, IRI)

We must know the variability of the inputs in order to predict future performance – the adequacy of the M-E design

Best Practices

- Understand data needs
- Detailed planning and collection procedures
- Training
- Field review before leaving site
- Time series review

Questions?